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Planetary Entry Probes in the Foreseeable Future: Destinations, Opportunities and Techniques

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Planetary atmospheric entry probes fill an important niche in solar system exploration, and will continue to do so in the future. They provide critical in situ measurements in locations where signals for remote sensing instruments are either obscured, are undetectably weak, or whose inversion is so fraught with ambiguities that researchers can reach no clear conclusions. NASA's 2003 Solar System Exploration Roadmap document (SSER) recognizes entry probes' importance in near-term, mid-term, and far-term missions1, with science objectives and advanced mission concepts that call for entry probes to a variety of destinations.

The SSER lists some specific destinations and missions appropriate for entry probes, but this presentation will also cover listed missions for which entry probes are not specified, but which could possibly deliver and/or support useful entry probes. Venus, Jupiter, Neptune, and Titan are all called out as high-priority destinations for entry vehicles in the next couple of decades. Those mission opportunities will be discussed. Mars is also given high priority, but that exploration program is more mature and its highest priorities are given to surface and subsurface science. Saturn and Uranus are not listed beyond the Cassini/Huygens mission, but both are attractive destinations. Also not listed are bodies with tenuous but fully collisional atmospheres, such as Io, Triton, and Pluto. Interest in in situ sampling of those atmospheres might complement nicely the interest in landers. There are now multiple programs at NASA by which such missions could be implemented. This includes the standard "line-item" approach, and multiple programs that place PI-led mission proposals in competition for cost-capped funding. NASA's Discovery Program is a prime example of the latter. Organization and funding aspects of these programs will be discussed.

Future entry probe missions should take advantage of technological advances to increase science return and reduce mission risk and cost. A variety of promising techniques will be discussed, ranging from science instruments to engineering systems to mission architectures.

reference: (1) Solar System Exploration Roadmap, NASA Office of Space Science publication, July 2003 (http://spacescience.nasa.gov/admin/divisions/se/SSE_Roadmap.pdf).